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A ZOOLOGICAL TRIBUTE.

Festschrift zum Sechzigsten Geburtstag Richard Hertwigs (München) geboren den 23. September, 1850, zu Friedrich, i.H. Erster Band, "Arbeiten aus dem Gebiet der Zellenlehre and Protozoenkunde." Pp. v+674+49 plates. Price 110 marks. Zweiter Band, "Arbeiten Morphologischen, Biologischen und Deszendenztheoretischen Inhalts." Pp. iii+624+30 plates. Price 70 marks. Dritter Band, "Experimentelle Arbeiten." Pp. iii+308+20 plates. Price 50 marks. (Jena: Gustav Fischer, 1910.)

THE three volumes before us represent one of the most remarkable tributes ever paid to a professor of zoology. We refer not merely to their size and weight, which have unfortunately hindered us from reviewing them more promptly, but to their high standard of workmanship and to the cordiality with which the various authors recognise indebtedness to their master for inspiration and instruction, for precept and example. It is true, of course, that those who have joined in this "Festschrift" to their highly esteemed teacher are now strongly marked individualities, ploughing their own furrows; yet it would be less than fair not to see that the diversity of contributions is correlated with the diversity of gifts in Richard Hertwig himself. For he has worked along many lines of zoology, and always with signal success—with a carefulness, thoroughness, and thoughtfulness which we should not presume to praise were they not reflected so clearly in the volumes which it is our business to-day to review. He has dealt with Protozoa and Metazoa, with morphology and physiology, with the most minute intricacies of the cell, with the big questions of sex and reproduction, and with the general problems of evolution. The congratulations of NATURE to Richard Hertwig, as one of the big international educationists in zoology of recent years, may be, through the reviewer's fault, a little belated, but they are none the less sincere. We wish for him many years of pleasant work, judiciously mingled with as much holiday as he can enjoy.

But how are we to review three enormous volumes with 1600 pages and a hundred plates? Perhaps the most useful way is the objective one of giving a rapid inventory of the treasures of this great Festschrift.

W. T. Howard leads off with an account of a peculiar kind of nuclear budding which occurs in the "depressed" cells of some tumours. It represents a reversion on the part of these cells to a primitive type of division common among certain Protozoa (such as Podophrya, according to Hertwig), and the author also suggests that the degeneration and extrusion of nuclear buds followed by mitosis of the mother nucleus is, in principle, comparable to the maturation division of egg cells. M. Popoff describes in various cells of Muscidæ what Hertwig called the formation of chromidia—the extrusion of chromatin from the nucleus into the cytoplasm. This colonisation of the cytoplasm by nucleoplasm seems to bear a relation to the functioning of the cell; thus the chromidia may be distributed along lines of diffusion currents. The author points out that what have been described as mitochondria, chondriomites, chondriokonts, pseudochromosomes, ergastoplasm, and so on, are simply phases of chromidia. Prof. Vlad. Ruzička has studied in *Bacterium nitri* the relations of chromatin and of plastin to the life of the cell, and finds that these two substances tend to be distributed respectively in areas of active and of reduced metabolism. In a paper with very striking illustrations, Th. Moroff describes what goes on inside the large Radiolarian Thalassicolla, the nucleus of which can be seen easily with the naked eye. The vegetative and reproductive phases are contrasted, and an account is given of the formation of isospores and anisospores. The author discusses such points as the significance of nucleoli, which are interpreted as forms of chromidia.

C. Clifford Dobell gives an account of his study of an interesting blood parasite, Hæmocystidium, discovered by Castellani and Willey in a Ceylon Gecko. He describes the schizogony and the formation of gametocytes, and contrasts the genus with the malarial organism, Plasmodium, to which it is closely akin. Hubert Erhard shows, in reference to the cells of the bile-duct in the snail, and of the epididymis in the white mouse, that the "trophospongia" of Holmgren is really a chromidial apparatus of nuclear origin. In regard to the epididymis he brings forward strong evidence that the secretion is due to the activity of the chromidia in the cytoplasm. In the next study Julius Schaxel describes the oogenesis of the well-known jellyfish Pelagia. He lays emphasis on the interesting give and take between nucleus and cytoplasm; from nutritive material supplied by the cytoplasm the nucleus forms chromatin, part of which is emitted from the nucleus into the cytoplasm to form physiologically important "kineto-chromidia." The history of the chromosomes in the larval salamander is the subject of a study by Karl Camillo Schneider—a kind of study which is difficult for those who have not a clue to the labyrinth of the nucleus. We may, however, point out that according to the author each chromosome of the nucleus in the prophase before division is bivalent, being composed of two "elementary structures" or "Mites," which are spirally coiled! In following the history of these spirals Schneider has found strong corroboration of Boveri's theory of the individuality of the chromosomes. In the next paper Paul Buchner gives a redescription—more penetrating than ever—of the spermatogenesis and oogenesis, the maturation and fertilisation in Sagitta.

E. A. Minchin describes *Malpighiella refringens*, a new amœboid parasite which he found in the malpighian tubes of the rat-flea (*Ceratophyllus fasciatus*), in which he was studying the transmission of *Trypanosoma lewisi*. It occurs principally in two forms—an amœboid form with a single nucleus, and an encysted form with four nuclei. In the next paper we are brought back again to chromidia, for Alexander Issakowitsch describes these on the marginal gland cells of Porpita, and shows that they play an essential part in the production of mucus. Then follows an interesting study by Rh. Erdmann, dealing with

Amoeba diploidea, which he kept at a temperature far above the normal. Nuclear degenerations and disturbances ensued, the culture became quite asexual, and sooner or later died off. In short, a state of "facultative apogamy" was experimentally induced, and the result afforded indirect evidence that part of the utility of the sexual process is to counteract "depressions" and disturbances of the cellular functions. Max Hartmann describes from the gut of a Termite a new representative of the very remarkable Protozoa known as Trichonymphidæ. He is inclined to make the family into a class comparable to Ciliata, but one almost hopes that this is going too far. Very remarkable they certainly are, with their males and females and young stages, their fission and gametogeny, their unique "head-organ" (probably a complicated blepharoplast), and their compound or "polyenergid" nucleus. Another interesting Protozoon, *Trypanosoma rotatorium,* Grube, from the frog, is redescribed by W. Lebedeff. It is remarkable for its striking polymorphism, for four principal forms occur. Another interesting parasite, a species of Lankesteria which lives in the food-canal of Turbellarians in Lake Baikal, is described by B. Swarczewsky. An account is given of the formation of gametes, their conjugation, the development of sporocysts, and of the life-history in general.

Very prominent in more ways than one is the description which Max Jörgensen gives of the growth of the ovarian ovum in Proteus. It occupies nearly 200 pages, and it is illustrated by twenty-three beautiful plates of cytological details. The author tells us all sorts of wonderful things, *e.g.* how the chromatin in the second stage of growth becomes pulverised, how the chromidium helps in the reconstruction, how the remarkable "lamp-brush" chromosomes arise, how the nucleoli migrate and what they do (probably serving as reservoirs for certain products of metabolism, and furnishing ferments which are useful in plasm-growth and yolk-formation. A most interesting account is given of the conditions of ooplasm-growth and of yolk-forming, and, in general, of the marvellous interactions between the different members of the cell-firm.

The second volume begins with a paper by J. P. Schtschelkanowzew on the internal and external male organs of Chelifer and Chernes. Among other interesting points the absence of a tail in the ripe spermatozoa may be noted. A discussion of the affinities of the Chelonethi leads to the conclusion that they are most nearly related to the Urotricha or Holopeltidia. Bruno Wahl deals with the classification of two families of Turbellarians, Dalyellidæ and Umagillidæ, which include a number of interesting and, in part, parasitic forms, such as Graffilla, Anoplodium, and Syndesmis. There seems to be some puzzle about *Graffilla parasitica,* which is abundant inside Tethys, for Wahl could find no trace of male gonads. Great interest attaches to the fine account which Sergius Kuschakewitsch gives of the development of the gonads in the edible frogs. It is a fine study in the origin and differentation of gonads, but it is also welcome in connection with experiments on sex-determination. The author contrasts the ovary and the testis stage after stage. There seems to be a remarkable lability in the details of the development, and the differences seem to depend partly on the locality and partly on the degree of ripeness of the eggs when they are fertilised. Confirmation is given of Hertwig's conclusion that over-ripeness of the ova results in a great preponderance of males. Philipp Lehrs takes us to a different kind of zoological problem in his discussion of a new species of Lacerta from Lebanon. He compares it with other mountain lizards, and shows the interest of it in binding together the Neo-Lacerta and Archæo-Lacerta species. C. Sasaki relates how he has almost cleared up the life-history of a rather famous aphis—*Schlechtendalia chinensis*—which makes galls on *Rhus semi-alata* in Japan and China. The galls are used in dyeing and tanning—they are rich in tannin, and in former times they served the Japanese women as a tooth-powder for blackening the teeth. Sasaki has succeeded in finding the wingless mother-insect, the fundatrix, who sets the ball a-rolling. Wingless females, parthenogenetic and viviparous, come and go; at length winged females appear which lay eggs, containing well-advanced embryos that soon hatch out. But no males have been seen, and we have a glimpse of a possibly continuous Parthenopeia.

R. Goldschmidt devotes a hundred pages to a searching account of the minute structure of the glia, the nerve-fibres, and the ganglion cells in the common threadworms of horse and man. He devotes particular attention to the neurofibrils, only, however, to rob them of their supposed nervosity, for he strongly maintains, with Apathy and others, that neurofibrils simply represent cellular skeleton. Goldschmidt has made in previous memoirs such a thorough analysis of the nervous system of Ascaris that he has the cells all numbered, and, as it were, ticketed. It is extraordinary indeed to read that "cell 26 of the internal lateral cephalic ganglion is present only in the males"—a fine instance, on the one hand, of penetrating analysis, and, on the other, of the penetrating nature of sex. O. Steche takes us to the open sea with his interesting study of the Portuguese man-of-war. He has introduced order into what he calls the "perplexing Wirrwar" of zooids, by discovering the law of budding. What is even more important, he shows how the development of the huge pneumatophore that projects above the waves has reacted on the architecture, leading to a great shortening of the stem and a giving up of the usual budding-zone. Incidentally, he mentions that Physalia has great power of regenerating lost appendages—a capacity which other Siphonophora are not known to possess.

In the next paper Harry Marcus makes another contribution to the much studied problem of the architecture of the head. He deals with Hypogeophis, one of the Gymnophiona, and discusses the "neuromerie, mesomerie, dermatomerie, and branchiomerie" of the head, which has at least nine segments. Adjoining this important, but highly technical contribution, there is a practical study by Schwangart, an authority on vine diseases. He deals with the deadly "Traubenwickler," caterpillars of two species of Tortricidæ, the ravages of which are nothing short of calamitous. In 1906 the loss in the Pfalz alone was estimated at six millions of marks. After discussing the life-history and habits, and the natural enemies of the caterpillars, as well as a variety of chemical, mechanical, and physical methods of dealing with the pest, the author gives an interesting account of their infection with a pathogenic mould, a species of Cordyceps. Ernst Stromer takes us back to ancient days in his discussion of the phylogeny of the Dipnoan stock, a subject raised by his very interesting discovery of teeth of both Protopterus and Lepidosiren in the Lower Oligocene of Egypt.

Plate's contribution to the Festschrift is an expanded version of the inaugural lecture which he gave in entering upon his duties as professor of zoology in Jena. He deals with the laws of inheritance in their relation to general evolution-theory. He has been breeding mice and has found not a single fact against the Mendelian theory. But he does not think that the selection theory has lost any of its importance. Some of his analyses of current conceptions are very interesting; thus he distinguishes seven forms of germinal variation, five kinds of atavism, and several kinds of correlation.

The third volume begins with observations by Arnold Lang on the heart-beats of hibernating snails. As the temperature falls the beats become fewer and fewer, but even at -3° C. they were still observed. A heart that can beat fifty times a minute in summer may only beat 2·36 times a minute at a temperature of $2{\cdot}65^{\circ}$ C. in February. In the next study Karl von Frisch takes us out to brooks and streams, and inquires into the colour-change of the trout and the minnow. It is many years since Pouchet demonstrated the importance of the sympathetic system in this connection, but von Frisch has already in this "vorlaüfige Mïtteilung" got further into the business. He has shown that there is in the anterior end of the medulla oblongata a special centre, the stimulation of which makes the fish lighter, *i.e.* makes the chromatophores contract. He has also found the place where the nerve-fibres that control the chromatophores pass out of the spinal cord into the sympathetic, in which they extend forwards and backwards.

By means of ingenious experiments, especially on bicephalous Planarians, Paul Steinmann has shown, for Triclads, that the nature of what is regenerated, *e.g.* whether a head or a tail, depends, not on the line of cutting, nor on the adjacent tissue, but on the regenerating organism as a whole. Even distant parts of the regenerant have their "organising" influence on the regenerate. Another paper dealing with regeneration is by Gustav Wolff, who reports on the continuation of his studies on newts. He has previously shown that the regeneration of the lens takes place apart from nervous stimulus, but now he shows that in the regeneration of the hind limb a nervous factor is indisputable. He makes much, for instance, of the remarkable fact that when an abnormal limb, say one with only two toes, is cut off, the regenerated limb has also only two toes. There is a very interesting historical reference to a forgotten paper by T. J. Todd, who directed attention, in 1823, to the influence of the nerve in the regeneration of the newt's leg.

An investigation of a very different type is that of W. F. Ewald on the contraction of the adductors in freshwater mussels. He has discovered a special "tonus-current," and gives a definition of the "tonic muscle-contraction." It is not oscillatory or discontinuous, but a persistent process, both in its mechanical and its electrical aspects. Albrecht Bethe deals with the equilibration of aquatic animals, discussing those with statocysts and those without, those the construction of which gives them an automatic stability, and those "labile" forms that keep themselves in a particular position by a coordination of movements. In some young fishes there is at first an automatic determination of the position, and the coordination is subsequently acquired. O. Maas has studied the peculiar involution-processes which occur in various sponges when they are starved or kept without sufficient lime salts. By passing into a resting stage, comparable to gemmules, the sponge may survive the disadvantageous conditions and exhibit subsequent revivification. One of the interesting general results is the corroboration of the view that sponges are essentially diploblastic. Th. Boveri has studied the developmental potencies of Ascaris-blastomeres in cases where the normal type of cleavage has been departed from, either as the result of double fertilisation or in consequence of centrifugal rotation. He gives the *coup de grâce* to the hypothesis of differential nuclear division.

F. Doflein takes us into the open-air again with his very interesting—though admittedly preliminary—study of the behaviour of two prawns, species of Leander, common on the Riviera coast. He discusses their fine coloration and its changes; the different kinds of chromatophores and pigments, red, blue, yellow, and white; their behaviour when feeding, when cleaning themselves, and so on; and the reactions to diverse stimuli.

This remarkable tribute, a credit alike to the genial professor and his school, ends with an interesting study of the awakening of the hibernating hedgehog. Whether automatically, or by "pulling itself together," the hedgehog warms itself up, and that rapidly. The chemistry of this, according to Tanzo Yoshida and Ernst Weinland, is that a rapid combustion of glycogen occurs, and that fat serves as an accessory fuel to the vital fire.

THE AGRICULTURAL DEVELOPMENT OF EGYPT.

Text-book of Egyptian Agriculture. Edited by G. P. Foaden and F. Fletcher. Vol. ii. Pp. viii+321–878. (Cairo: National Printing Department, 1910.) Price 9*s*.

IN the agricultural development of a country two lines of attack have always to be followed: investigations are made with the objects of discovering the best crops to grow and the best methods to follow; and the cultivator—who is generally constitutionally conservative—has to be persuaded that the